Small Business Innovation Research/Small Business Tech Transfer

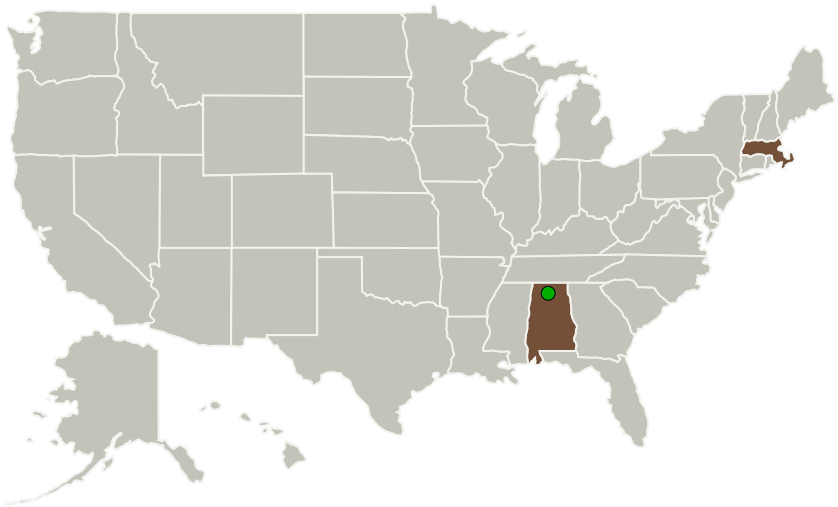
Next Generation Gamma/Neutron Detectors for Planetary Science, Phase II

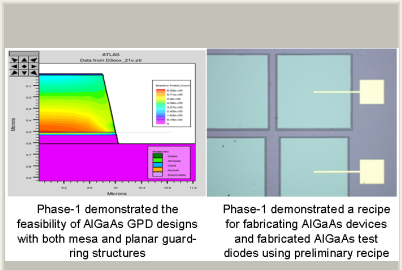
Completed Technology Project (2013 - 2015)

Project Introduction

Gamma-ray and neutron spectroscopy are well established techniques for determining the chemical composition of planetary surfaces, and small cosmic bodies such as asteroids and comets; however, new technologies with the potential to significantly improve the performance of planetary nuclear spectroscopy are emerging. We propose to develop new gamma-ray and neutron detectors based on wide-band-gap (WBG) solid-state photomultiplier (SSPM) photodetectors coupled to emerging scintillation materials such as Cs2YLiCl6:Ce (CLYC), and CeBr3 for gamma and neutron spectroscopic studies of planet surfaces and small cosmic bodies. The proposed SSPM photodetector for scintillation readout is based on AlGaAs, a WBG compound semiconductor with aluminum concentration of 60% to 90%. The ~2-eV band-gap energy of this material is engineered to match the emission spectrum of both CLYC and CeBr3. The high band-gap of AlGaAs also provides much lower dark noise and better radiation tolerance than Si-based detectors. Compared to conventional PMTs, the compact size, low voltage operation, and lighter weight of AlGaAs SSPM is ideal for spaced-based instruments. The advantages of AlGaAs SSPMs and the excellent detection properties of CLYC and CeBr3 scintillation materials make them a perfect match in the development of new gamma and neutron spectrometers for planetary science.

Primary U.S. Work Locations and Key Partners





Phase-1 demonstrated the feasibility of AlGaAs GPD designs with both mesa and planar guard-ring structures

Phase-1 demonstrated a recipe for fabricating AlGaAs devices and fabricated AlGaAs test diodes using preliminary recipe

Next Generation Gamma/Neutron Detectors for Planetary Science.

Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Project Transitions	2
Images	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Technology Areas	3
Target Destinations	3

Next Generation Gamma/Neutron Detectors for Planetary Science, Phase II

Completed Technology Project (2013 - 2015)

Organizations Performing Work	Role	Type	Location
Radiation Monitoring Devices, Inc.	Lead Organization	Industry	Watertown, Massachusetts
Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

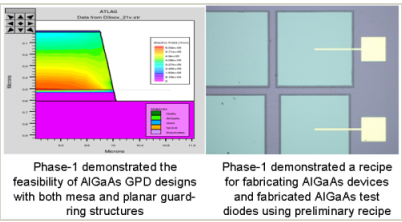
Primary U.S. Work Locations	
Alabama	Massachusetts

Project Transitions

July 2013: Project Start

July 2015: Closed out

Images



Project Image
Next Generation Gamma/Neutron Detectors for Planetary Science.
(https://techport.nasa.gov/image/127485)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Radiation Monitoring Devices, Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

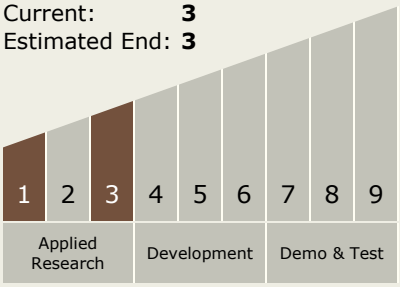
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
James Christian

Technology Maturity (TRL)

Start: **1**
Current: **3**
Estimated End: **3**



Next Generation Gamma/Neutron Detectors for Planetary Science, Phase II

Completed Technology Project (2013 - 2015)

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.1 Detectors and Focal Planes

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System